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ARS Journal
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Australian Journal of *Applied Science*
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Bituminous Coal Research
Brennstoff-Chemie (German)
British Coal Utilization Research Association *Monthly Bulletin* and *Quarterly Gazette*
Business Week
Butane-Propane News

California Oil World
Canadian Chemical Processing
Canadian Gas Journal
Canadian Journal of *Chemical Engineering*
Canadian Journal of *Chemistry*
Canadian Journal of *Physics*
Catalysis, Journal of
Ceramics (British)
Chemical and *Engineering Data*, Journal of
Chemical & Process Engineering
Chemical Documentation, Journal of
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Chemical Engineering Progress
Chemical Physics, Journal of
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Chemical Society, Proceedings (British)
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Coal, Today & Tomorrow (formerly Coal Heat)
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Datamation
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Electrical World
Electrochemical Society, Journal of
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Engineers' Digest (British)
Erdöl und Kohle (German)

Faraday Society, Transactions of (British)
Fortune
Fuel (British)
Fuel Efficiency (British)
Fueloil & Oil Heat

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Gas and Coke (British)
Gas Council Research Communications (British)
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Gas Journal (British)
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Gas Times (British)
Gas-und Wasserfach (German)
Gas World (British)
Gazovaya Promyshlennost (Russian)

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Petroleum Engineer, The (Drilling and Producing)
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Petroleum Technology Journal of
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